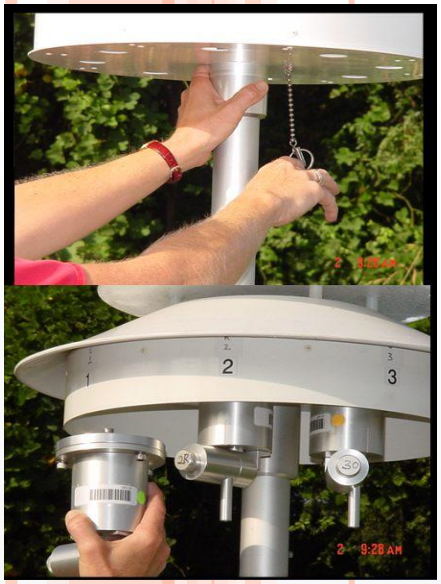


D H E C

PROMOTE PROTECT PROSPER

South Carolina Department of Health and Environmental Control

POSSIBLE CAUSES OF $PM_{2.5}$ AT THE IRMO SAMPLING STATION

Tommy Flynn

Air Planning and Assessment Section

Bureau of Air Quality, Department of Health and Environmental Control

Irmo $PM_{2.5}$ Stakeholders

November 28, 2007

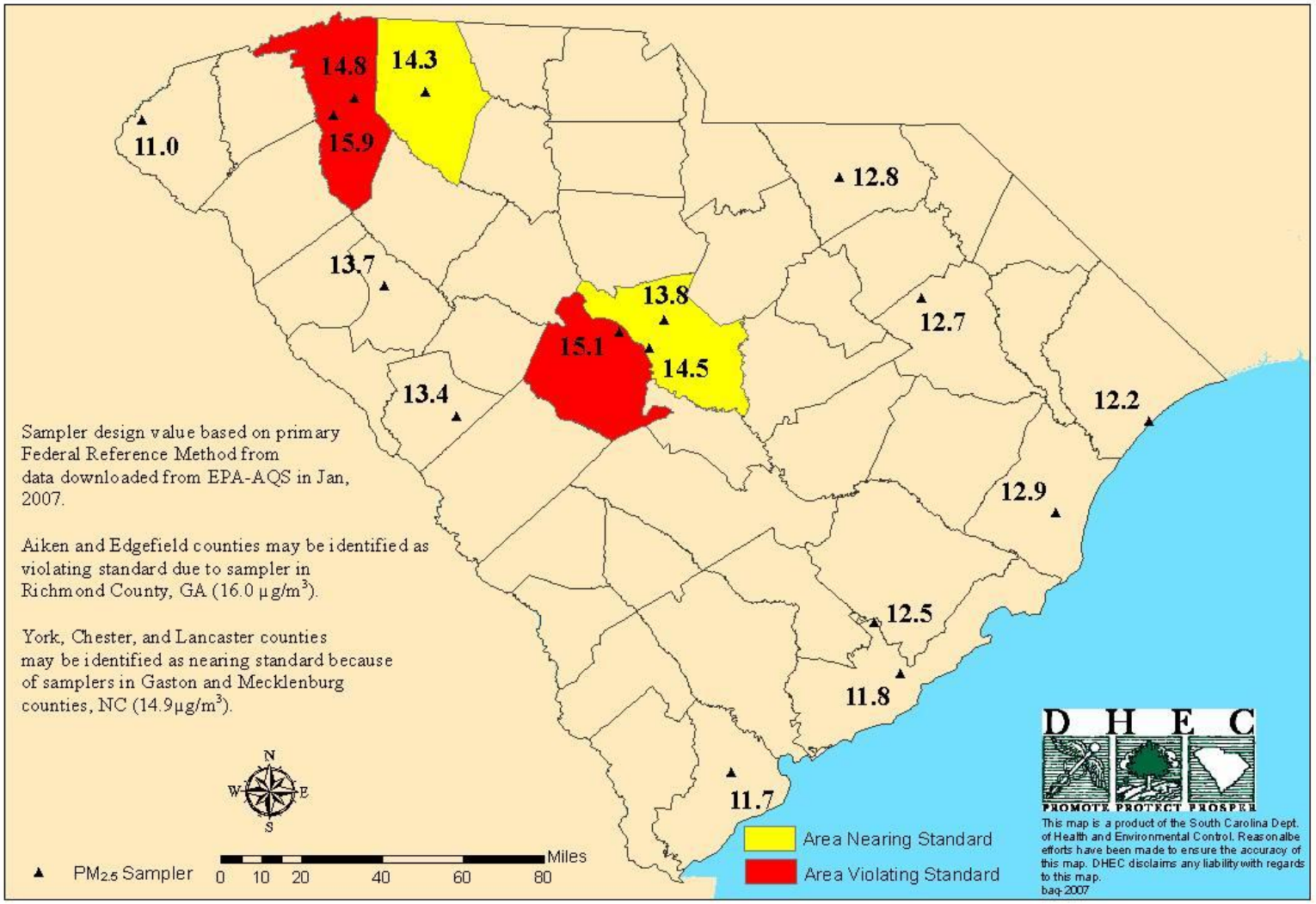
Agenda

- What is the $PM_{2.5}$ standard?
- What is the current reading at the Irmo station?
- What are the Columbia Area Design Value Trends?
- Why do speciation sampling?
- Where does DHEC conduct speciation sampling?
- What are the major components of $PM_{2.5}$ in South Carolina?
- Where do the major components of $PM_{2.5}$ come from?
- What can be done with speciation sampling?
- What are the possible sources of $PM_{2.5}$ at the Irmo sampling station?
- Is speciation sampling coming to Irmo?

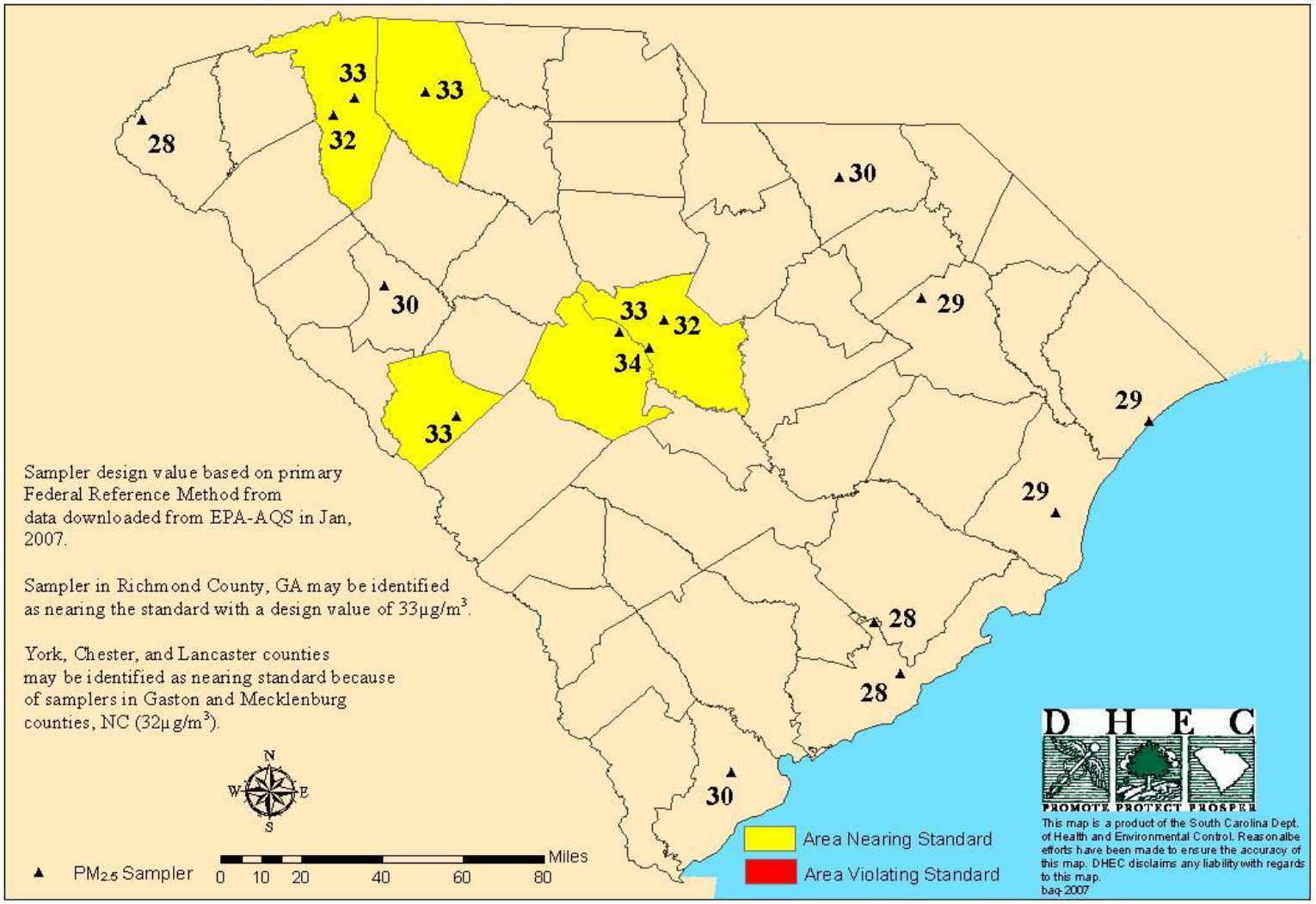
WHAT IS THE $PM_{2.5}$ STANDARD?

- There are two forms of the $PM_{2.5}$ National Ambient Air Quality Standards (NAAQS).
  - The annual standard is set at 15µg/m^3 averaged over three years.
  - The daily standard is set at 35µg/m^3 (set as the 98th percentile) averaged over three years.

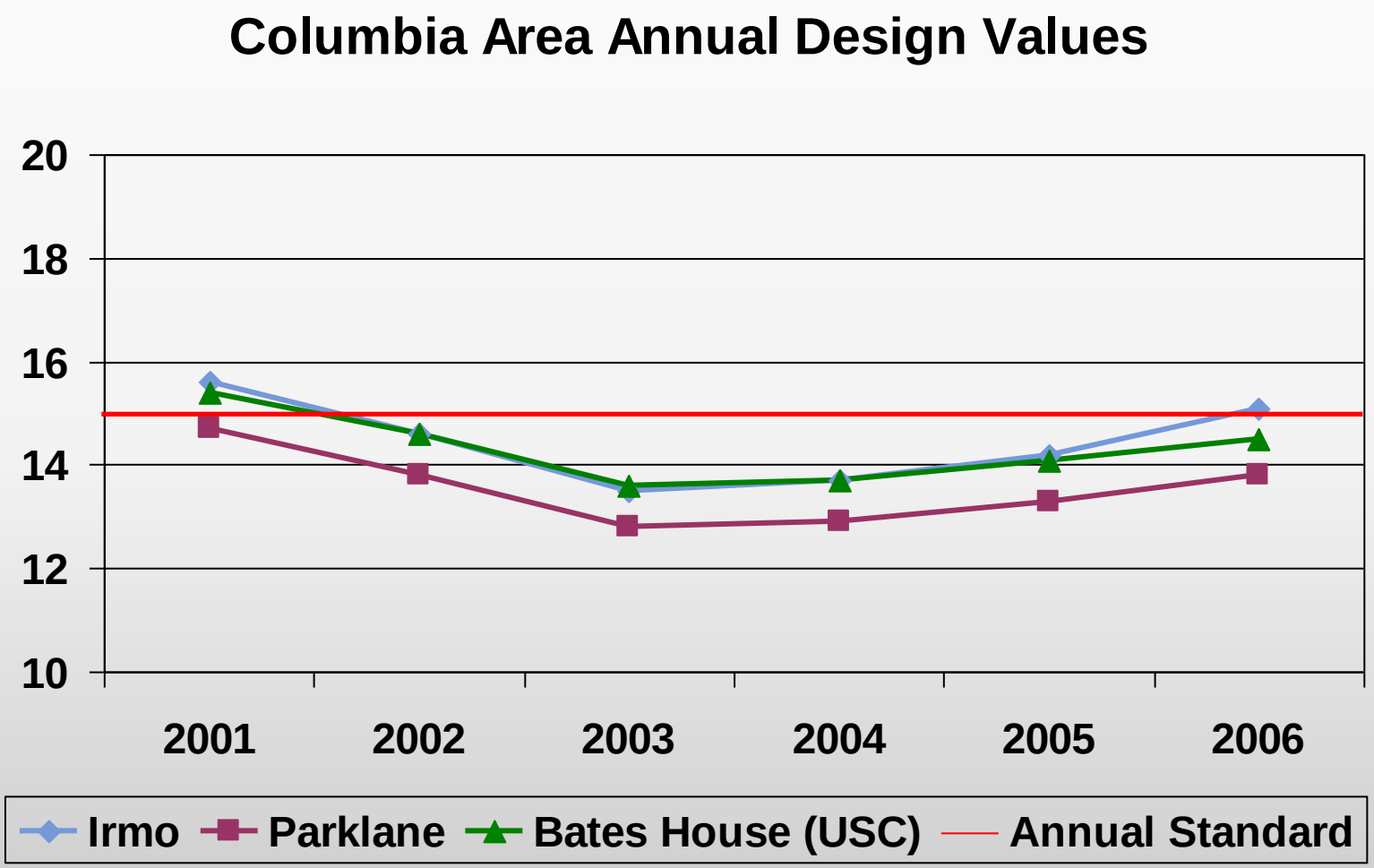
WHAT IS THE CURRENT ANNUAL DESIGN VALUE AT THE IRMO STATION?



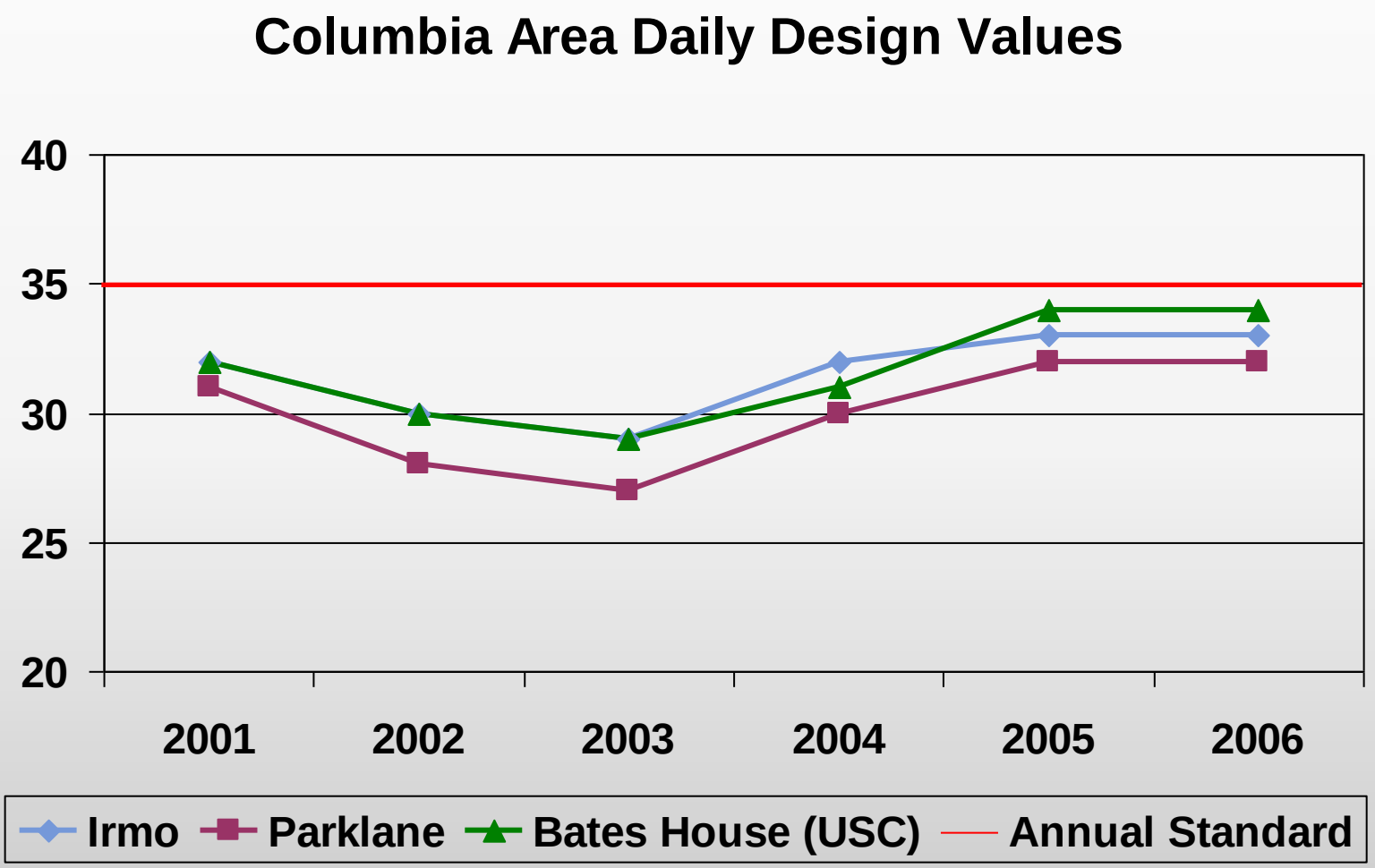
WHAT IS THE CURRENT DAILY DESIGN VALUE AT THE IRMO STATION?



WHAT ARE THE COLUMBIA AREA DESIGN VALUE TRENDS?



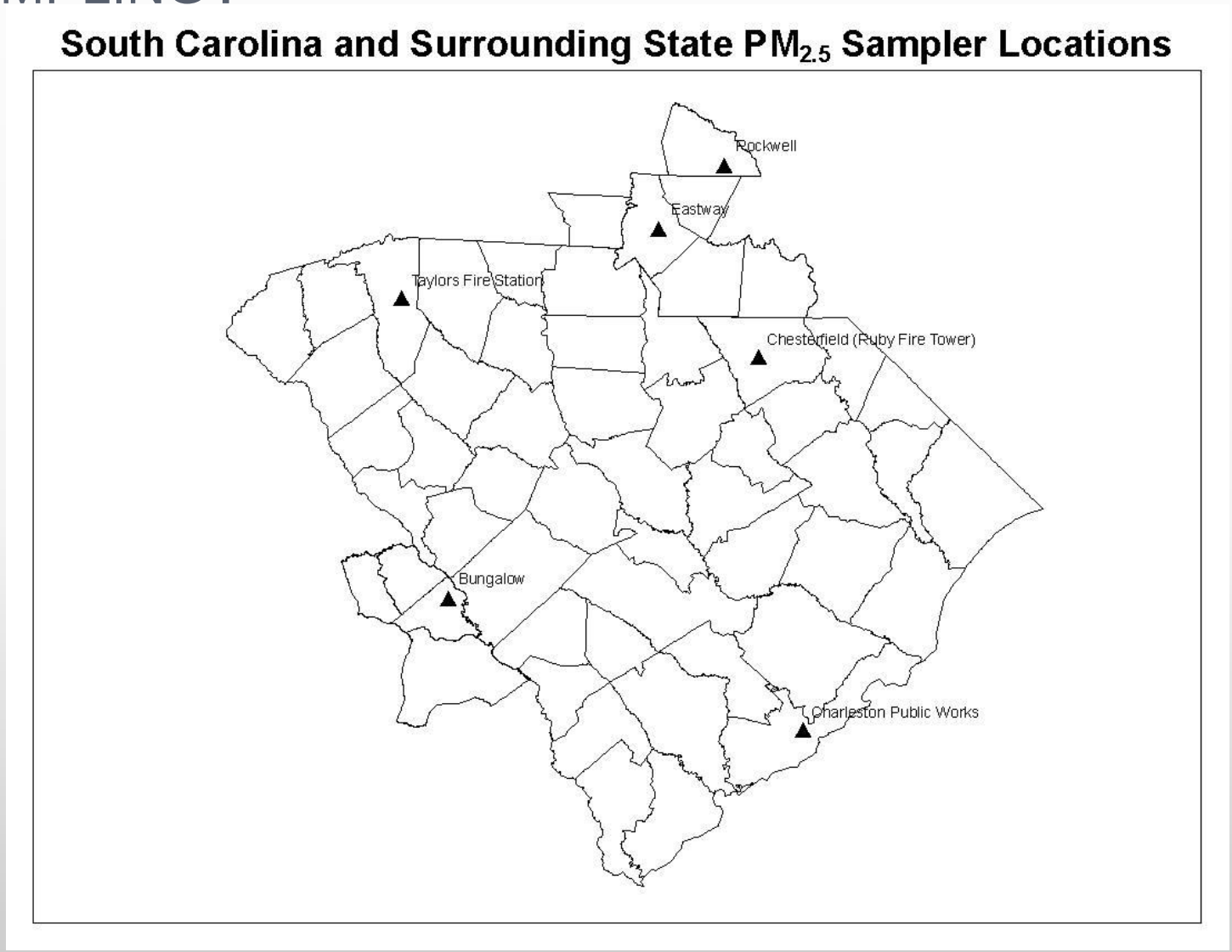
WHAT ARE THE COLUMBIA AREA DESIGN VALUE TRENDS?



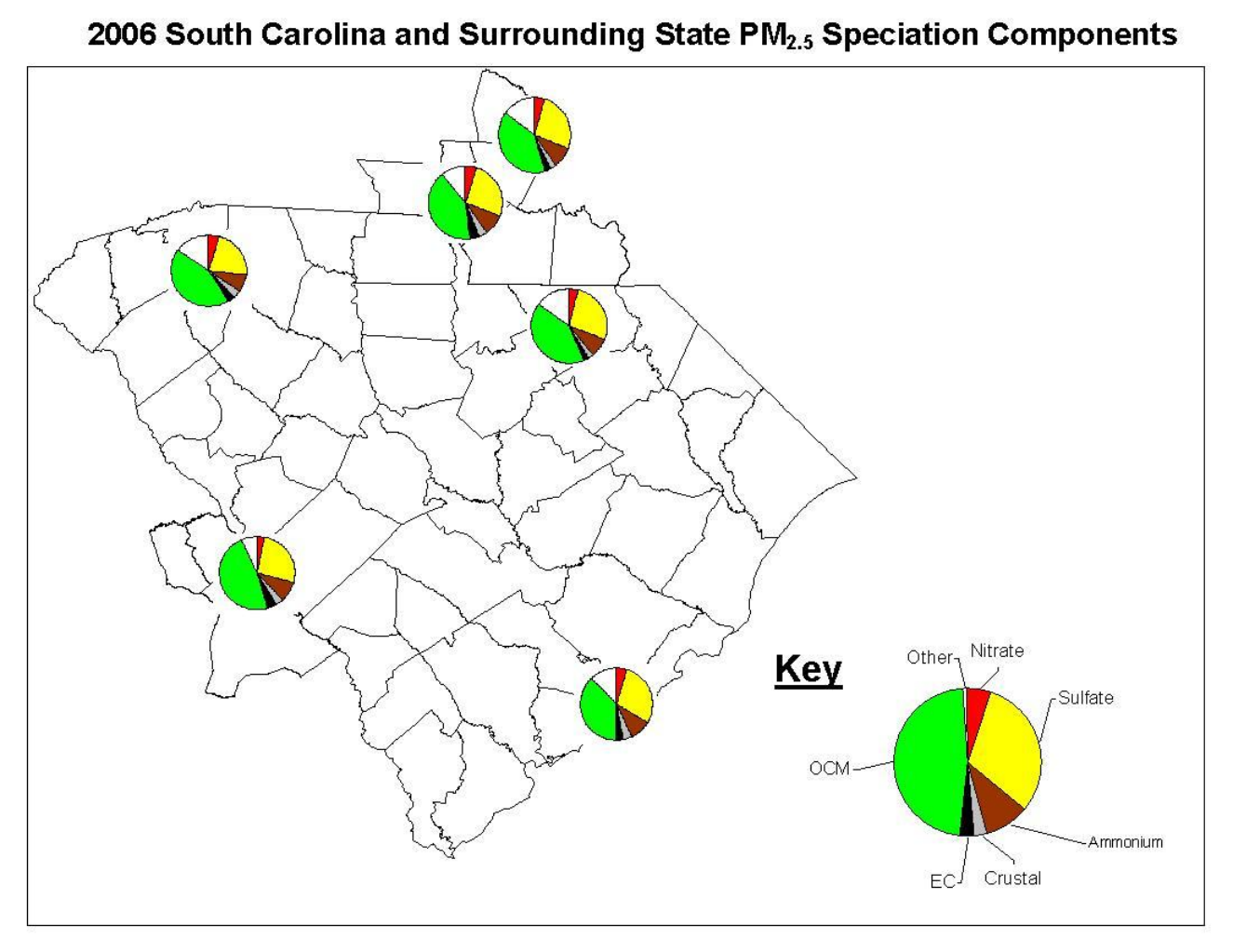
WHY DO SPECIATION SAMPLING?

- Chemical speciation sampling is part of the major monitoring requirements set forth in 40 CFR Part 58, Ambient Air Quality Surveillance for Particulate Matter.
- Data can be used to:
  - Help to implement the $PM_{2.5}$ standard by using speciated data as input to air quality modeling analyses and as indicators to track progress of controls;
  - Aid in the understanding of health studies by linking effects to $PM_{2.5}$ constituents;
  - Understand the effects of atmospheric constituents on visibility impairment; and
  - Use the speciated particulate data to aid in monitoring network design and siting adjustment.

Where does DHEC conduct speciation sampling?



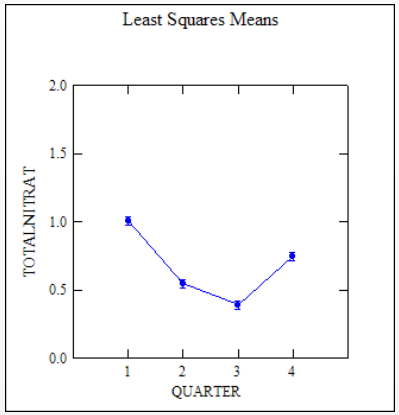
WHAT ARE THE MAJOR COMPONENTS OF $PM_{2.5}$ IN SOUTH CAROLINA?

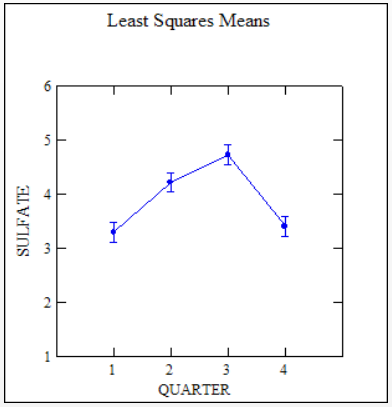


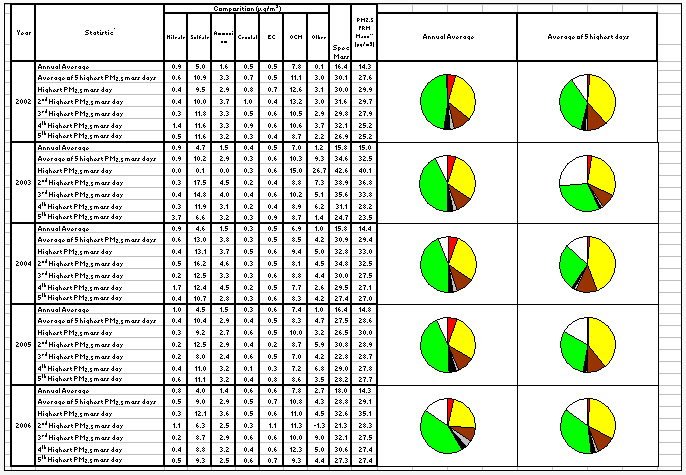
WHERE DO THE MAJOR COMPONENTS OF $PM_{2.5}$ COME FROM?

Species	Possible Sources
Sulfate	Fossil fuel combustion
Nitrate	Industrial and automobile emissions, organic decomposition
Organic Mass by Carbon	Biomass burning, automobile emissions, fossil fuel combustion, gas-to-particle conversion of hydrocarbons
Soil	Desert dust, construction, road dust

What can be done with speciation sampling?







Year	Statistic	Composition (µg/m³)							Spec. Mass	PM2.5 FRM Mass (µg/m³)	Annual Average	Average of 5 highest days
		Nitrate	Sulfate	Ammonium	Crustal	EC	OCM	Other				
2002	Annual Average	0.9	5.0	1.6	0.5	0.5	7.8	0.1	16.4	14.3		
	Average of 5 highest PM2.5 mass days	0.6	10.9	3.3	0.7	0.5	11.1	3.0	30.1	27.6		
	Highest PM2.5 mass day	0.4	9.5	2.9	0.8	0.7	12.6	3.1	30.0	29.9		
	2nd Highest PM2.5 mass day	0.4	10.0	3.7	1.0	0.4	13.2	3.0	31.6	29.7		
	3rd Highest PM2.5 mass day	0.3	11.8	3.3	0.5	0.6	10.5	2.9	29.9	27.9		
	4th Highest PM2.5 mass day	1.4	11.6	3.3	0.9	0.6	10.6	3.7	32.1	28.2		
	5th Highest PM2.5 mass day	0.5	11.6	3.2	0.3	0.4	8.7	2.2	26.9	25.2		
2003	Annual Average	0.9	4.7	1.5	0.4	0.5	7.0	1.2	15.8	15.0		
	Average of 5 highest PM2.5 mass days	0.9	10.2	2.9	0.3	0.6	10.3	9.3	34.6	32.5		
	Highest PM2.5 mass day	0.0	0.1	0.0	0.3	0.6	15.0	26.7	42.6	40.1		
	2nd Highest PM2.5 mass day	0.3	17.5	4.5	0.2	0.4	8.8	7.3	38.9	36.8		
	3rd Highest PM2.5 mass day	0.4	14.8	4.0	0.4	0.6	10.2	5.1	35.6	33.8		
	4th Highest PM2.5 mass day	0.3	11.9	3.1	0.2	0.4	8.9	6.2	31.1	28.2		
	5th Highest PM2.5 mass day	3.7	6.6	3.2	0.3	0.9	8.7	1.4	24.7	23.5		
2004	Annual Average	0.9	4.5	1.5	0.2	0.5	6.9	1.0	15.8	14.4		
	Average of 5 highest PM2.5 mass days	0.6	13.0	3.8	0.3	0.5	8.5	4.3	30.9	29.4		
	Highest PM2.5 mass day	0.4	13.1	3.7	0.5	0.6	9.4	5.0	32.8	33.0		
	2nd Highest PM2.5 mass day	0.5	16.2	4.6	0.3	0.5	9.1	4.5	34.8	32.5		
	3rd Highest PM2.5 mass day	0.2	12.5	3.3	0.3	0.6	8.8	4.4	30.0	27.5		
	4th Highest PM2.5 mass day	1.7	12.4	4.5	0.2	0.5	7.7	2.6	29.5	27.1		
	5th Highest PM2.5 mass day	0.4	10.7	2.8	0.3	0.6	8.3	4.2	27.4	27.0		
2005	Annual Average	1.0	4.5	1.5	0.3	0.5	7.4	1.0	16.4	14.8		
	Average of 5 highest PM2.5 mass days	0.4	10.4	2.9	0.4	0.5	8.3	4.7	27.5	28.6		
	Highest PM2.5 mass day	0.3	9.2	2.7	0.6	0.5	10.0	3.2	26.5	30.0		
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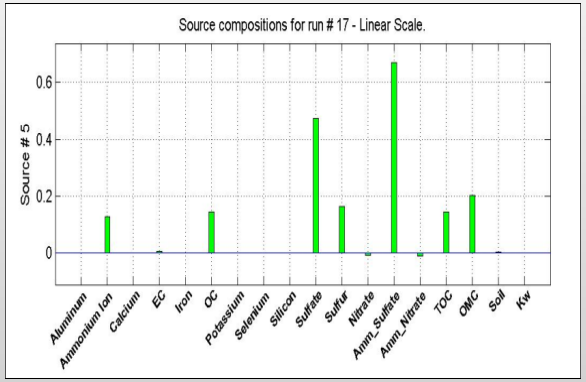
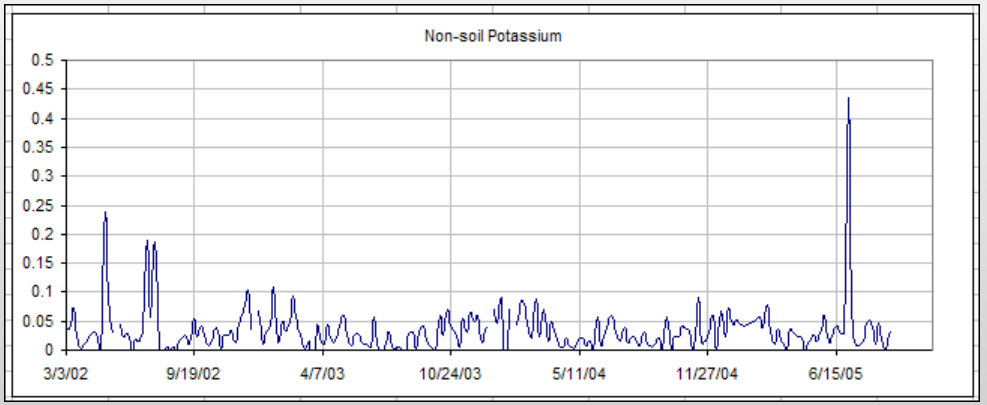
2006	Annual Average	0.8	4.0	1.4	0.6	0.6	7.8	2.7	18.0	14.3		
	Average of 5 highest PM2.5 mass days	0.5	9.0	2.9	0.5	0.7	10.8	4.3	28.8	29.1		
	Highest PM2.5 mass day	0.3	12.1	3.6	0.5	0.6	11.0	4.5	32.6	35.1		
	2nd Highest PM2.5 mass day	1.1	6.3	2.5	0.3	1.1	11.3	-1.3	21.3	28.3		
	3rd Highest PM2.5 mass day	0.2	8.7	2.9	0.6	0.4	10.0	9.9	32.1	27.5		
	4th Highest PM2.5 mass day	0.4	5.8	2.2	0.4	0.6	12.3	5.9	30.6	27.4		
	5th Highest PM2.5 mass day	0.5	9.3	2.5	0.6	0.7	9.3	4.4	27.3	27.4		





MAJOR COMPONENT TRENDS

- Can be used to see how the major components of $PM_{2.5}$ vary over time.

Year	Statistic	Composition ($\mu g/m^3$)									Annual Average	Average of 5 highest days
		Nitrate	Sulfate	Ammonium	Crustal	EC	OCM	Other	Spec Mass	PM2.5 FRM Mass** ($\mu g/m^3$)		
2002	Annual Average	0.9	5.0	1.6	0.5	0.5	7.8	0.1	16.4	14.3		
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	4th Highest $PM_{2.5}$ mass day	1.4	11.6	3.3	0.9	0.6	10.6	3.7	32.1	25.2		
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	4th Highest $PM_{2.5}$ mass day	0.3	11.9	3.1	0.2	0.4	8.9	6.2	31.1	28.2		
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	Average of 5 highest $PM_{2.5}$ mass days	0.6	13.0	3.8	0.3	0.5	8.5	4.2	30.9	29.4		
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	2nd Highest $PM_{2.5}$ mass day	0.5	16.2	4.6	0.3	0.5	8.1	4.5	34.8	32.5		
	3rd Highest $PM_{2.5}$ mass day	0.2	12.5	3.3	0.3	0.6	8.8	4.4	30.0	27.5		
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2005	Annual Average	1.0	4.5	1.5	0.3	0.6	7.4	1.0	16.4	14.8		
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	3rd Highest $PM_{2.5}$ mass day	0.2	8.7	2.9	0.6	0.6	10.0	9.0	32.1	27.5		
	4th Highest $PM_{2.5}$ mass day	0.4	8.8	3.2	0.4	0.6	12.3	5.0	30.6	27.4		
	5th Highest $PM_{2.5}$ mass day	0.5	9.3	2.5	0.6	0.7	9.3	4.4	27.3	27.4		



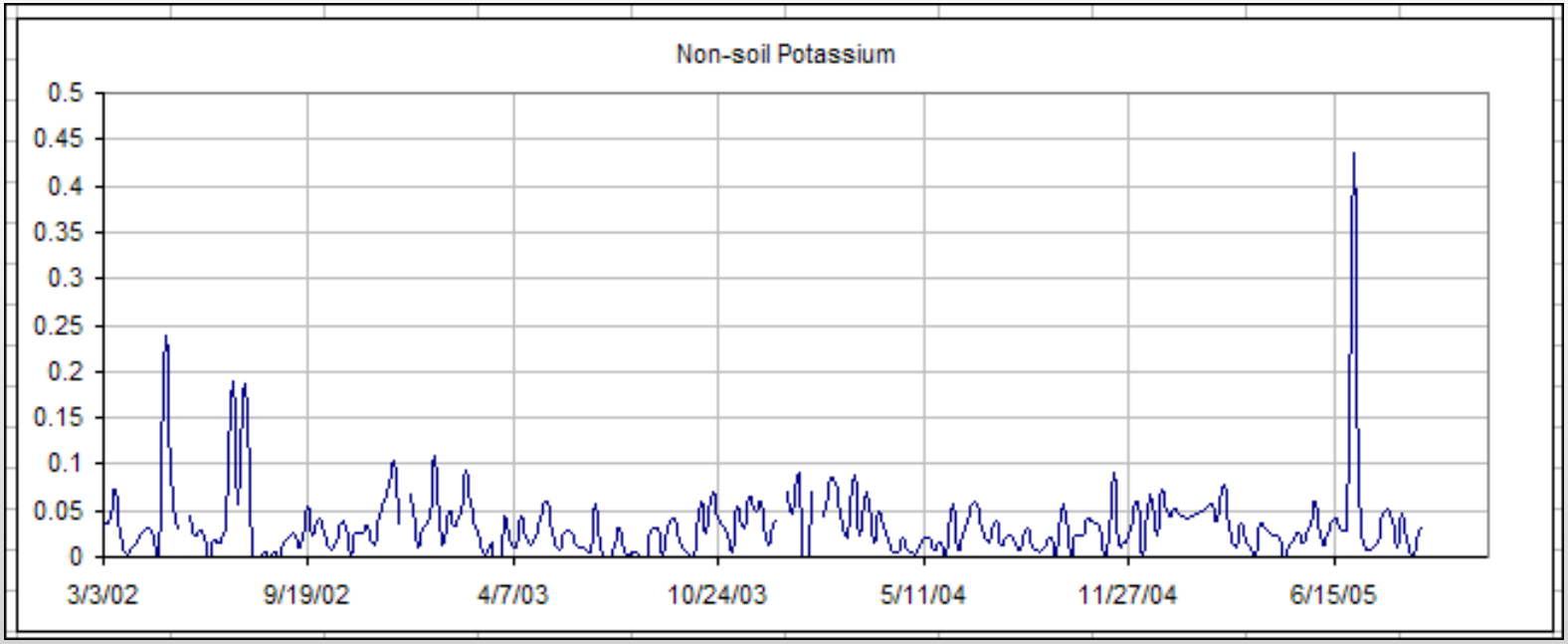






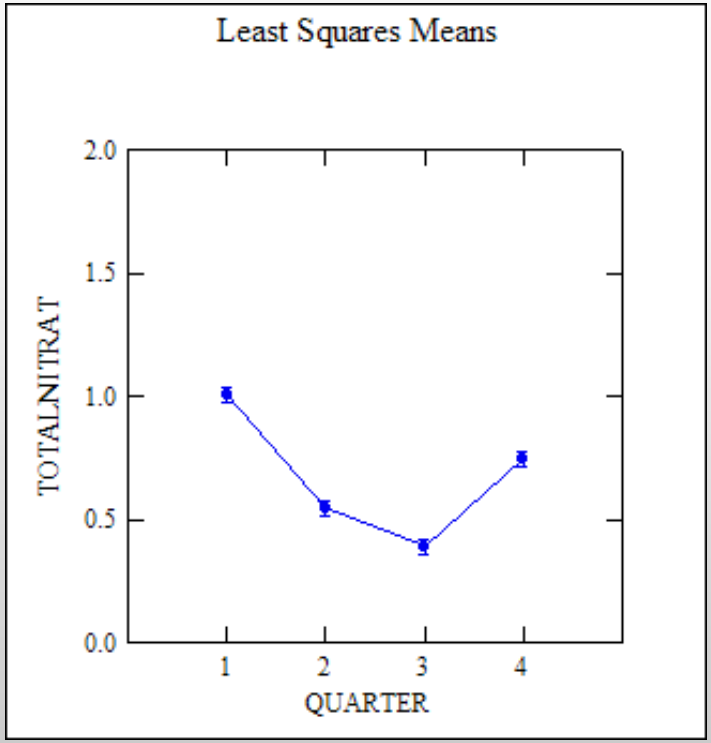

EXCEPTIONAL EVENT DETECTION

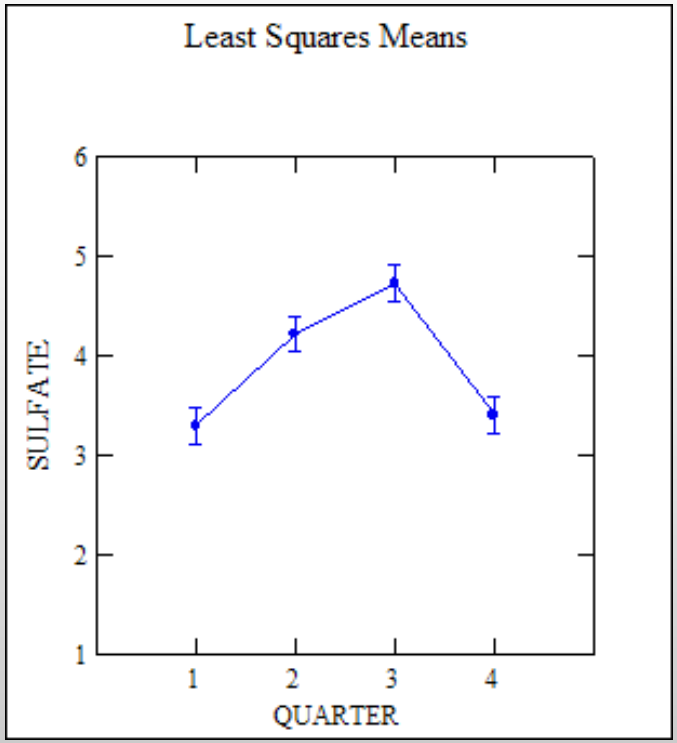
- Time-series plots can be used to detect one time events that affect air quality.
  - In the plot below, potassium spikes on July 3rd . This event may be related to fireworks.



TREND ANALYSIS

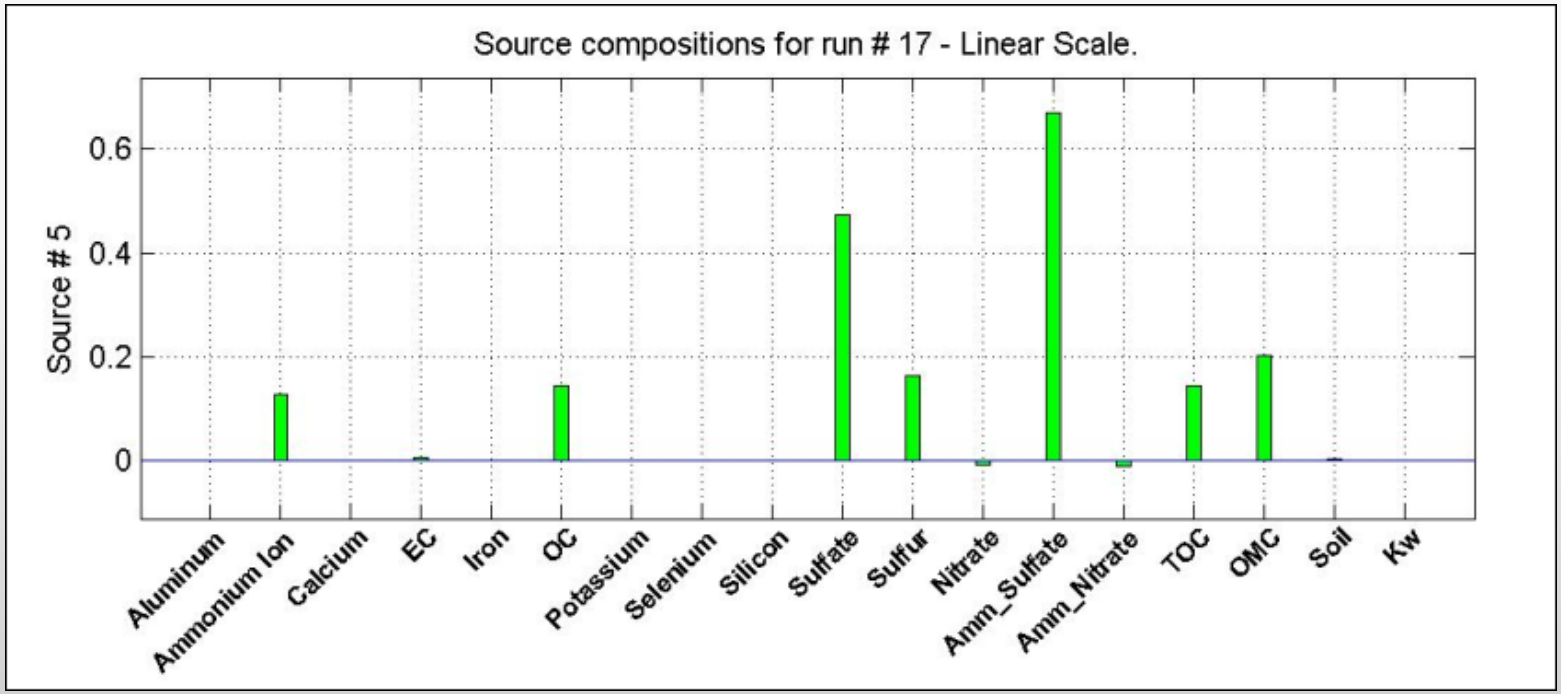
- Speciation data can be used to determine when the highest concentrations of a component occur.
  - In the examples below, nitrate has a high average concentration during the winter months. Sulfate has a high average concentration during the summer months.





SOURCE APPORTIONMENT STUDIES

- Speciation data can be used to identify contributing source types.
  - In this example, a sulfate signal is detected through a source apportionment model.



WHAT ARE THE POSSIBLE SOURCES OF $PM_{2.5}$ AT THE IRMO SAMPLING STATION?

- In ambient monitoring, the sources could be numerous.
  - Examples of sources of $PM_{2.5}$ could be point sources, area sources, automobiles, open burning, etc.
  - Without speciation sampling a definitive answer is hard to make.

Is speciation sampling coming to Irmo?

Questions?

Contact information:

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